Physical Properties

TMG uses the Meshing Task's Physical Properties function to define the physical characteristics of Thin Shell (2D) and Beam (1D) elements, as well as Lumped Mass elements. To create a physical property, pick the *Physical Property* icon. On the Physical Property Tables form, select the Order of the element you wish to create (2D, 1D or Other), then select *TMG/ESC* from the the analysis program menu at the upper right.

Supported Physical Properties

Thin Shell (2D) Elements

- *Thickness*: represents the phycical thickness of the shell for conduction.
- *Number of Layers*: See article Using Multilayer Elements
- Non-Structural Mass: See Adding Thermal Mass below

Beam (1D) Elements

- Non-Structural Mass: See Adding Thermal Mass below
- Note: The cross section of a beam is not defined as a physical property. To define the cross section of the beam, create a beam section in the Beam Section task, and load the section into the model.

Lumped Mass Elements

- *Mass*: See Adding Thermal Mass, below
- *Diameter*: Used for determining surface area for thermal couplings, boundary conditions

Adding Thermal Mass (Capacitance)

You can add arbitrary thermal mass to shell, beam and lumped mass elements. This can be useful when modeling physical features that do not appear in the FE model due to modeling choices (simplification, existing mesh etc.).

The mass (capacitance) is added to that calculated from the Rho, Cp and volume of each element. For beam or shell elements, create the thermal mass by specifying a Physical Property that includes a non-structural mass value.

For Lumped Mass elements TMG supports only two values as physical properties: diameter and mass. Since there are no materials associated with a Lumped Mass element, TMG must assume a specific heat value to evaluate the capacitance of the element. A C_p value of *1.0 J / ° C Kg* is assumed. In order to adjust the capacitance, we can assign a different mass to the element. Therefore, the specified mass value for a mass element is given by:

$$M_{specified} = M_{actual} \times Cp_{actual}$$

For example, to model a *1.0 Kg* mass with a material having a capacitance of *900J/°CKg*, we must specify a mass value of *900Kg*.

To use another unit system, adjust the mass value by the conversion factor to convert capacitance units from SI to the unit system. If $FSI_{->Unit\ System}$ is the conversion factor for capacitance units,

$$M_{specified} = M_{actual} \times Cp_{actual} \times FSI_{\rightarrow UnitSystem}$$
